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TROPICAL FOREST U·P·D·A·T·E

A Newsletter from the International Tropical Timber Organization to Promote Conservation and Sustainable Development of Tropical Forests

Volume 7, No 2 ISSN 1022-5439 1997/2

A Plantation Perspective

In 1993, ITTO published its *Guidelines for the Establishment and Sustainable Management of Planted Tropical Forests* in recognition of the increasingly significant role played by plantations in supplying timber markets. Between 1980 and 1990 the area of land in the Tropics turned over to plantations increased from 18 million hectares to 44 million hectares – a rise of 150 per cent – and the trend continues. Indeed, in a recent report to ITTO on the resources and costs required to achieve the Year 2000 Objective, the establishment of new forest plantations emerged as a prominent component in many of the country estimates submitted.

This issue of the *TFU* focuses on industrial plantations. In recent years there has been a growing realisation that the viability of a plantation should no longer be regarded in terms of financial returns alone. Plantations must be seen in the context of their surrounding ecosystems and consideration of potential environmental and social impacts is fundamental. With this has come the call for greater attention to be given to the use of native species.

In pages 3–5, a series of options is considered for ways to restore biodiversity to degraded land utilising plantations of native timber species. What has restricted widespread implementation of the proposed practices is largely attributed to a lack of information about native species and their site requirements – this contrasts with the extensive research that has been carried out on exotic species. This insufficiency is also highlighted in the recently released ITTO report on *Biotechnology and the Sustainable Production of Tropical Timber* summarised on page 16. Furthermore, an ITTO project in Ghana investigating the susceptibility of native species to pests in plantations, reports that the scarcity of data on pest-tree dynamics is one of the key factors which has restricted the development of native species plantations (pp 6–7).

The successes of industrial plantations in Latin America discussed on pages 8–9 confirm that there is certainly a place for exotics. Interest in teak, in particular, continues unabated and a review of the management of this popular species and developments in its vegetative propagation are reported on pages 10–13. A brief examination of another hardwood, mahogany (p. 14), defies the myth that this most prized of timbers is not a 'plantation species'.

Datuk Leo Chai, former Director of Forests, Sarawak, predicts (p. 17) that demand for utility timber will increasingly be supplied by the large industrial plantations while natural forests will provide the high quality logs required for specialised products. Such complementary systems bode well for the future of both the industry and forest biodiversity. A similar balance between the roles of plantations of exotic and of native species might enhance prospects further.

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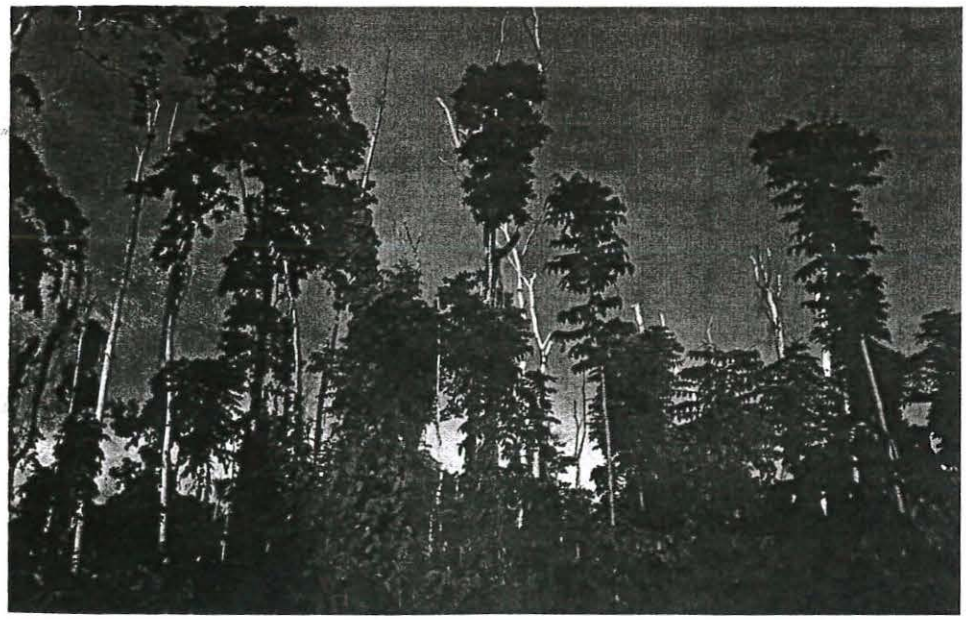

Pruned mahogany in enrichment lines, Kolombangara, Solomon Islands. Photo: J Mayhew

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Vegetative Propagation of Teak

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Tectona grandis, commonly known as teak, has gained a worldwide reputation as a high quality timber on account of the attractiveness and the durability of the wood it produces. This species occurs naturally, although discontinuously, in deciduous forests between latitudes 9°–26°N, and 73°–104°E longitude, which includes central and southern India, Myanmar, northern Thailand and Laos. It has subsequently been introduced to many South-East Asian countries such as Indonesia, Sri Lanka, Vietnam, West and East Malaysia and the Soloman Islands, as well as some African countries such as Côte d'Ivoire, Nigeria and Togo.

In 1990, the species was reported to cover about 2.5 million hectares but the resources available remain far below the huge market demand. Planting stock is still produced from seeds despite certain handicaps associated with this, such as quantitatively limited and late seed production, low germination rates, substantial variability in growth and wood quality among individuals within progenies and a lack of accurate knowledge about the inheritance of economically significant traits (White, 1991). It was these limitations which prompted the current work by CIRAD-Forêt and Innoprise Corporation Sdn Bhd of the Sabah Foundation, to explore the potential to propagate teak vegetatively by cuttings and micro-shoots.

Essentially, vegetative propagation, in contrast to propagation by seeds, enables the capture and transfer to the asexually obtained offspring of the integral genetic material of the donor tree from which they derive. This is of paramount importance, bearing in mind that in teak, as in other tree species, certain traits of major economic significance, such as tree growth, are largely the result of non-additive gene effects which cannot be reproduced through propagation by seeds.

Vegetative propagation can be applied to a group of specimens with different genetic constitutions (genotypes) without having to maintain any individual identification – this is referred to as 'bulk propagation'. The main interest of bulk propagation consists of mass propagating by cuttings a limited number of juvenile genotypes of high and similar genetic value derived, for instance, from controlled pollination. The other option involves clonally mass propagating selected superior genotypes based on their visible characteristics (phenotypes).

Rooted Cuttings

The techniques developed in the nursery conditions have established that 70 to 80 per cent of the cuttings corresponding to several mature selected genotypes can be rooted and subsequently developed into superior quality cloned offspring (Monteuuis *et al,* 1995). Records to date have shown that 40 rooted cuttings can be produced annually per stock plant, which corresponds to 600 rooted cuttings per square metre. This, however, requires the stock plants to be managed in a very intensive way, in order to stimulate the production of a certain morphological type of shoot associated with a high potential for adventitious rooting (Monteuuis, 1995, Monteuuis *et al,* 1995). After trimming, these shoots are rooted under mist system facilities for six weeks and then raised in culture containers for two to three months prior to field planting. So far, several thousand cuttings have been produced under these conditions within this project.

Micro-shoots

The tissue culture protocols used were conceived in as simple a manner as possible in order to cope with the constraints of large-scale application, i.e. low costs and a high productivity rate. The technology developed enables the mass micropropagation of any genotype by axillary shoot with exponential multiplication rates of three to four new shoots every two months (Monteuuis, 1995). The rooting-acclimatisation phase was achieved in nursery conditions under a mist system with 95 per cent success. Mortality during the subsequent steps of cultivation in the nursery before the plants are sufficiently developed to be field planted is negligible overall. To date, more than 50,000 micro-shoots have been produced by this unit and these have developed rapidly into vigorous and true-to-type vegetative offspring of superior quality.

Future Development

Although the efficiency of both the nursery and the tissue culture options for mass propagating vegetatively superior genotypes of teak has been assessed, the favouring of either method of propagation or a combination of both, will be determined by economic considerations. Comparative assessments in this respect are still in progress.

The plants issued from rooted cuttings, as well as those from *in vitro* micro-shoots, have now been planted in the field and are currently under evaluation. After two to three years' growth, their performances look impressive. Some of the cuttings have been sold to companies and smallholders in Sabah and this commercial activity is planned to be developed further. With the recent surge in interest in both the overseas and local markets for tissue cultured plantlets, particularly in conjunction with reafforestation programmes, the future prospects for vegetative propagation of teak using nursery and tissue culture techniques look promising.

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